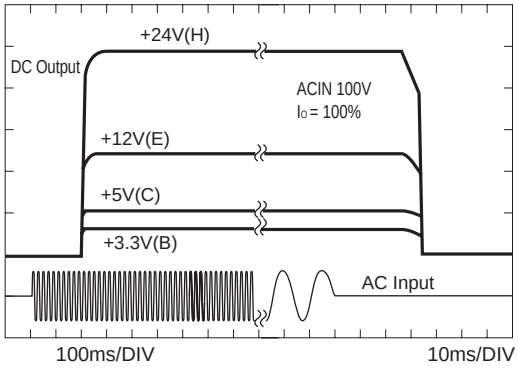
Basic Characteristics Data

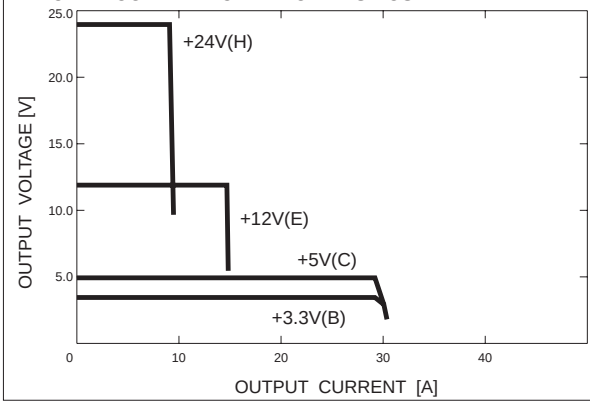
Model	Circuit method	Switching frequency [kHz]	Input current [A]	Rated input fuse	Inrush current protection	PCB/Pattern			Series/Parallel operation availability	
						Material	Single sided	Double sided	Series operation	Parallel operation
Input module of ACE300F	Active filter	80	3.7∗1	250V 8A	SCR	FR-4		Yes	No	No
Input module of ACE450F	Active filter	80	5.7∗2	250V 10A	SCR	FR-4		Yes	No	No
Input module of ACE650F	Active filter	80	8.0∗3	250V 15A	SCR	FR-4		Yes	No	No
Input module of ACE900F	Active filter	80	11∗4	250V 20A	SCR	FR-4		Yes	No	No
Output module A–K	Forward converter	120	–	–	–	FR-4		Yes	Yes∗5	Yes∗7
Output module 2A–2K	Forward converter	120	–	–	–	FR-4		Yes	Yes∗5	Yes∗7
Output module L,M,N,P,R	Forward converter	120	–	–	–	FR-4		Yes	Yes∗5	No
Output module Y,W,Z,9,Q,V	Forward converter	120	–	–	–	FR-4		Yes	Yes∗6	No
Output module S,T,U	Forward converter	120	–	–	–	FR-4		Yes	Yes∗6	No

∗1 Input current is based on Model AC3-HEEC-00 outputs 250W at AC100V.
∗2 Input current is based on Model AC4-HHECC-00 outputs 400W at AC100V.
∗3 Input current is based on Model AC6-HHECC-00 outputs 600W at AC100V.
∗4 Input current is based on Model AC9-HHEECC-00 outputs 800W at AC100V.
∗5 Series operation is possible with the same output modules.
∗6 Series operation is possible, but series bar cannot be set by the series code.
∗7 Parallel operation is possible with the same output voltage module.

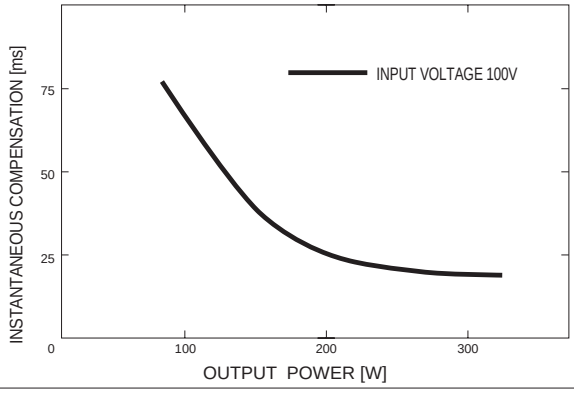
●RISE TIME & FALL TIME



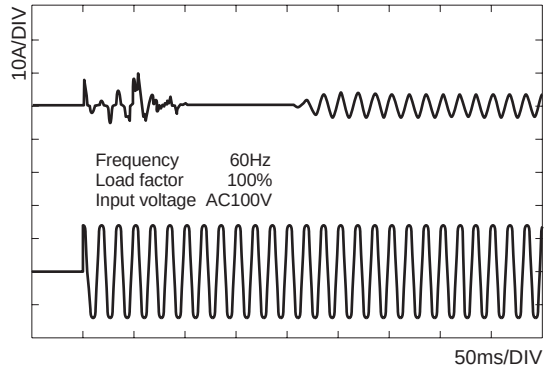
●OVER CURRENT CHARACTERISTICS



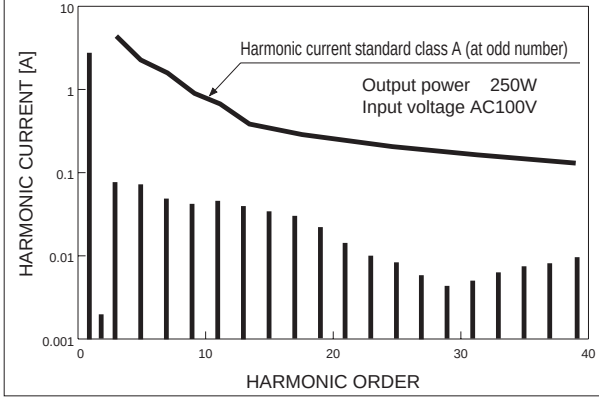
●INSTANTANEOUS INTERRUPTION COMPENSATION (AC3-HEEC-00)



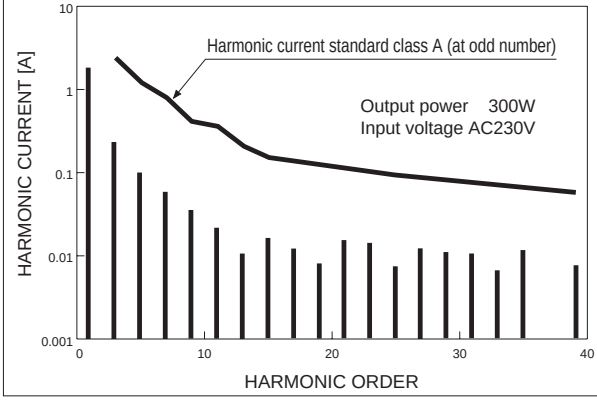
●INRUSH CURRENT (AC3-HEEC-00)



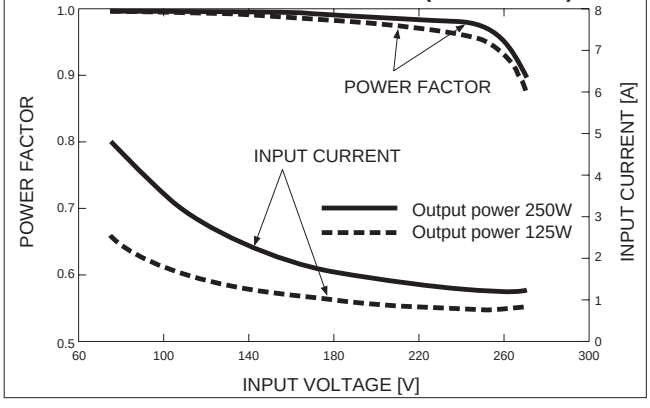
●INPUT HARMONIC CURRENT AC100V (AC3-HEEC-00)



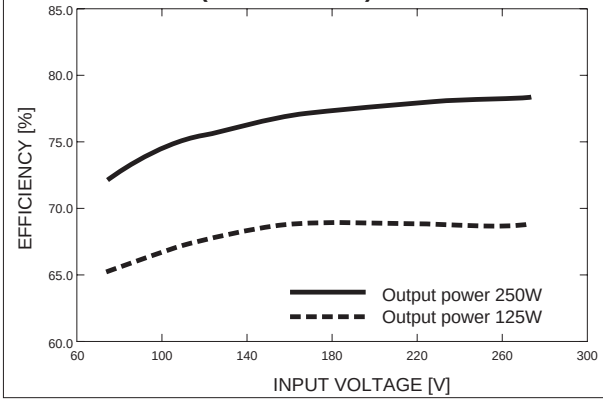
●INPUT HARMONIC CURRENT AC230V (AC3-HEEC-00)



●POWER FACTOR & INPUT CURRENT (AC3-HEEC-00)

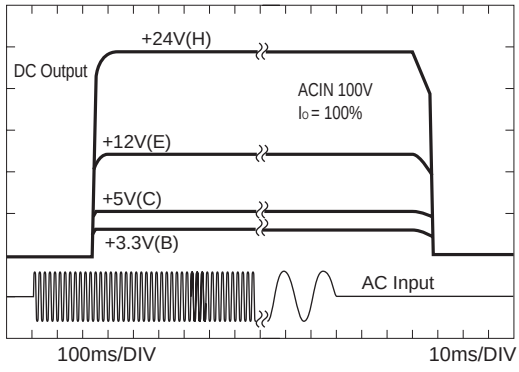


●EFFICIENCY (AC3-HEEC-00)

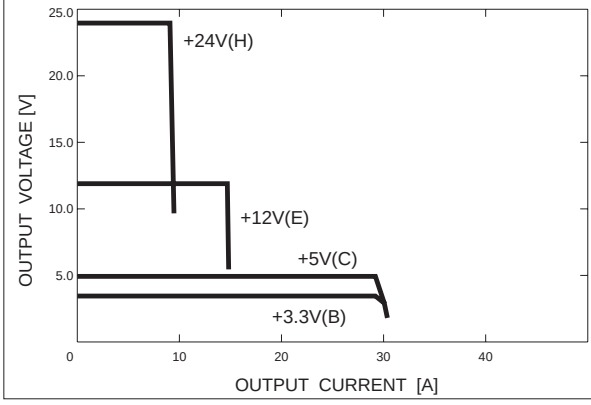


ACE

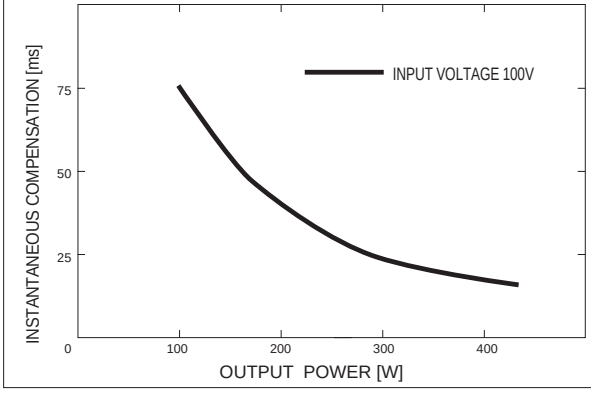
●RISE TIME & FALL TIME



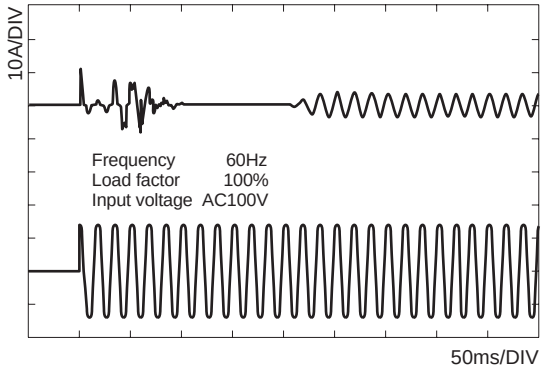
●OVER CURRENT CHARACTERISTICS



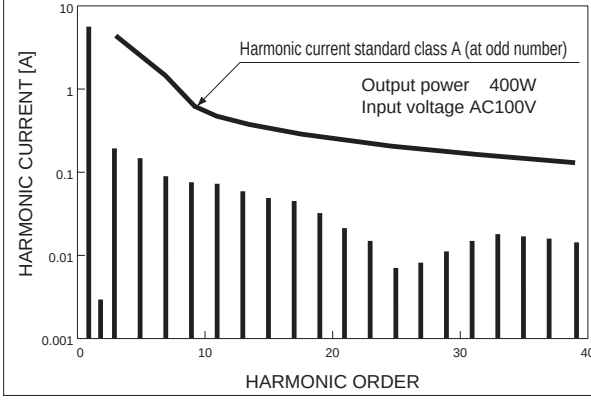
●INSTANTANEOUS INTERRUPTION COMPENSATION (AC4-HHECC-00)



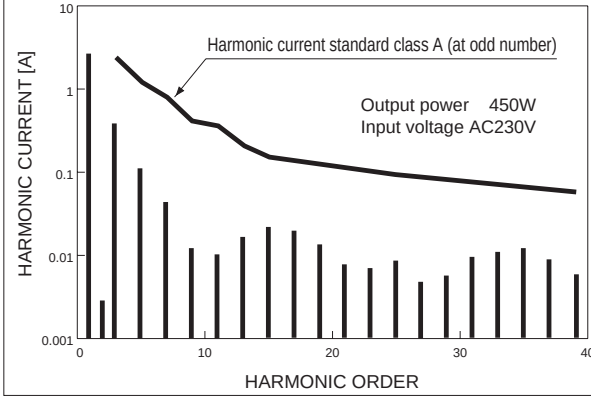
●INRUSH CURRENT (AC4-HHECC-00)



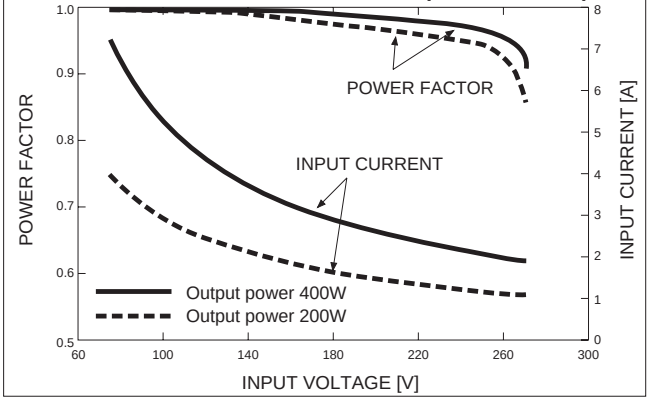
●INPUT HARMONIC CURRENT AC100V (AC4-HHECC-00)



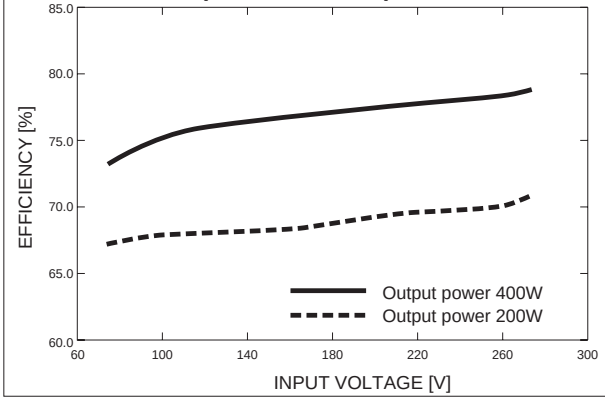
●INPUT HARMONIC CURRENT AC230V (AC4-HHECC-00)



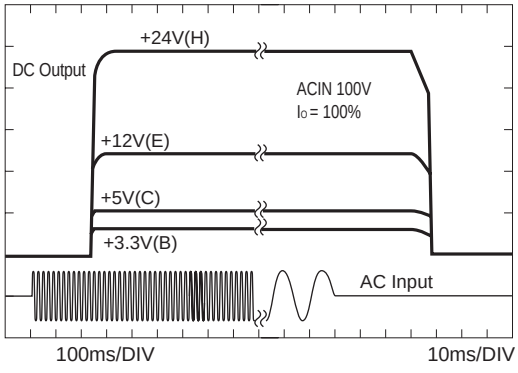
●POWER FACTOR & INPUT CURRENT (AC4-HHECC-00)



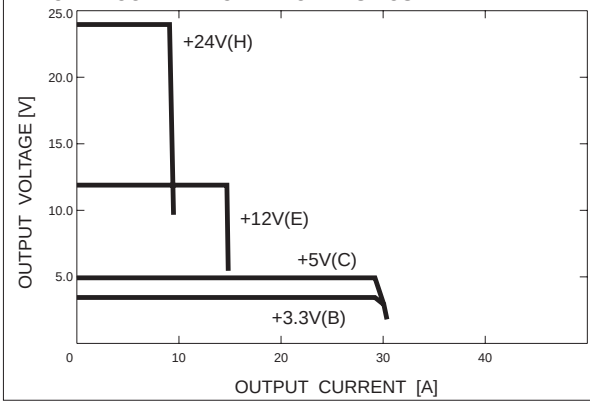
●EFFICIENCY (AC4-HHECC-00)



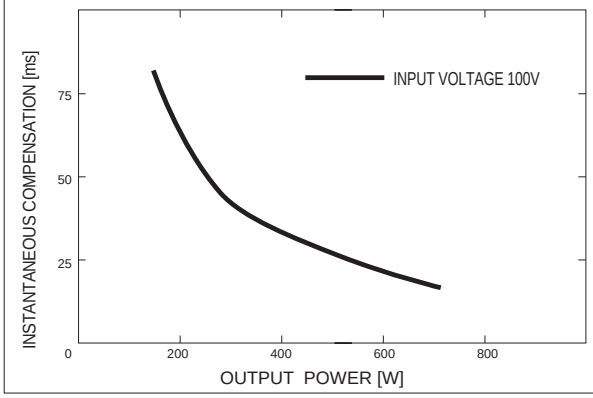
●RISE TIME & FALL TIME



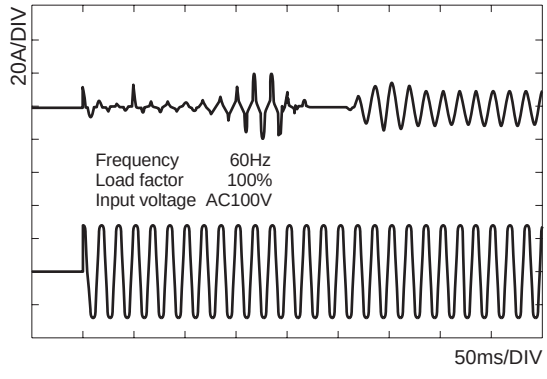
●OVER CURRENT CHARACTERISTICS



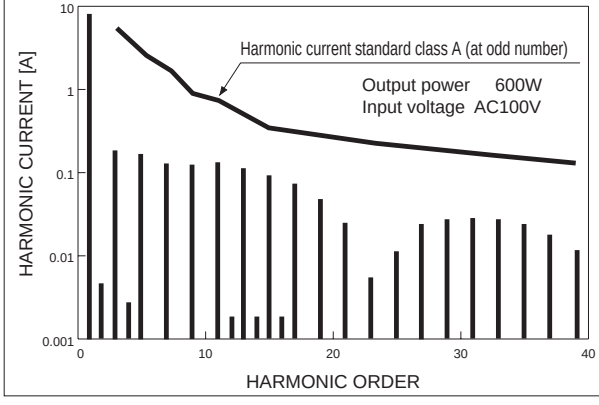
●INSTANTANEOUS INTERRUPTION COMPENSATION (AC6-HHECC-00)



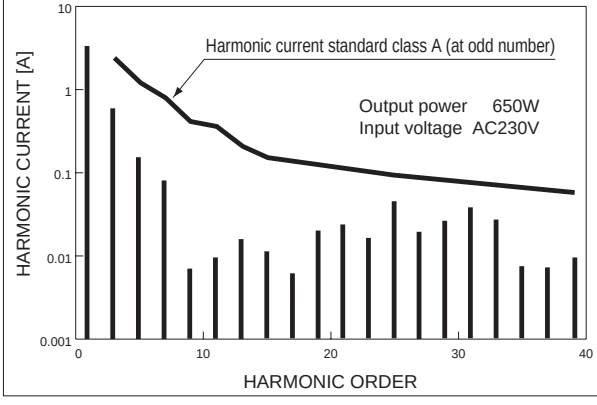
●INRUSH CURRENT (AC6-HHECC-00)



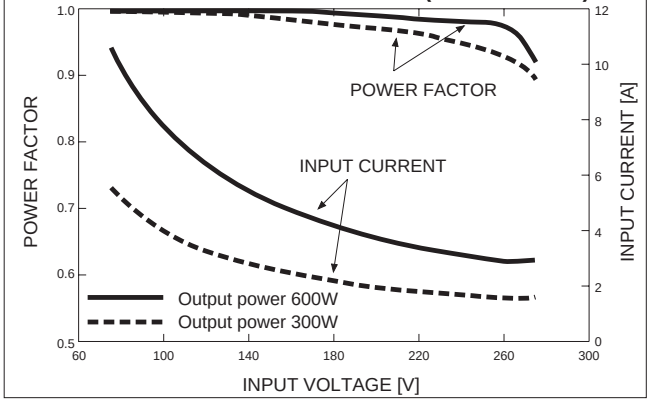
●INPUT HARMONIC CURRENT AC100V (AC6-HHECC-00)



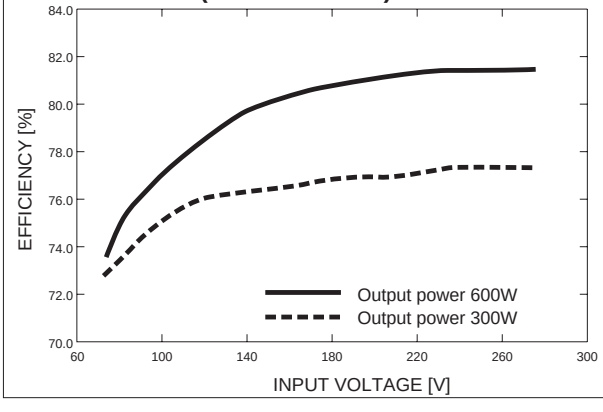
●INPUT HARMONIC CURRENT AC230V (AC6-HHECC-00)



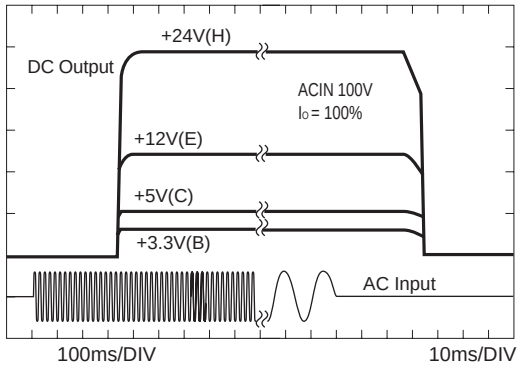
●POWER FACTOR & INPUT CURRENT (AC6-HHECC-00)



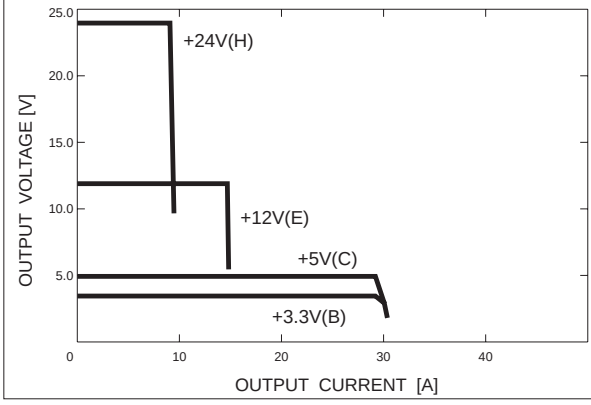
●EFFICIENCY (AC6-HHECC-00)



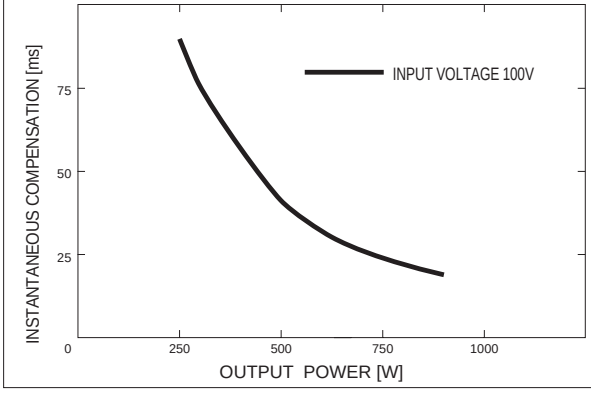
●RISE TIME & FALL TIME



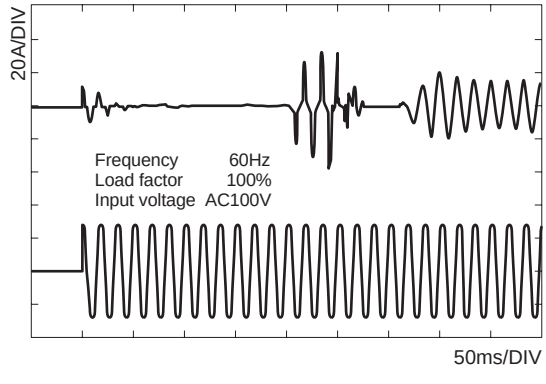
●OVER CURRENT CHARACTERISTICS



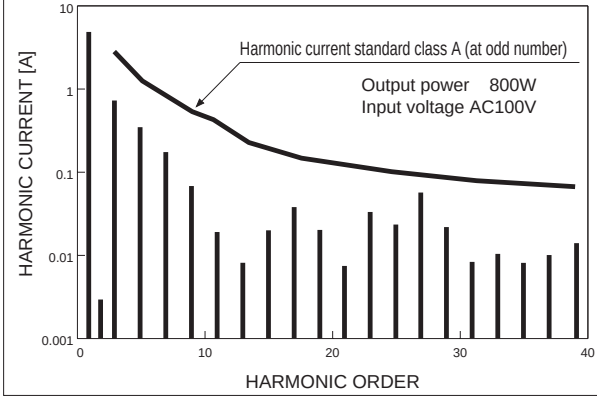
●INSTANTANEOUS INTERRUPTION COMPENSATION (AC9-HHEECC-00)



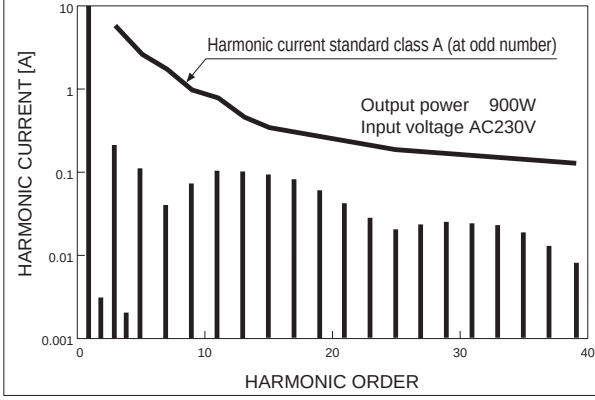
●INRUSH CURRENT (AC9-HHEECC-00)



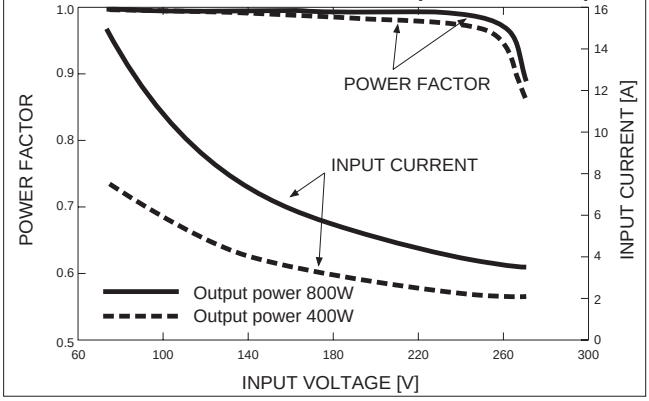
●INPUT HARMONIC CURRENT AC100V (AC9-HHEECC-00)



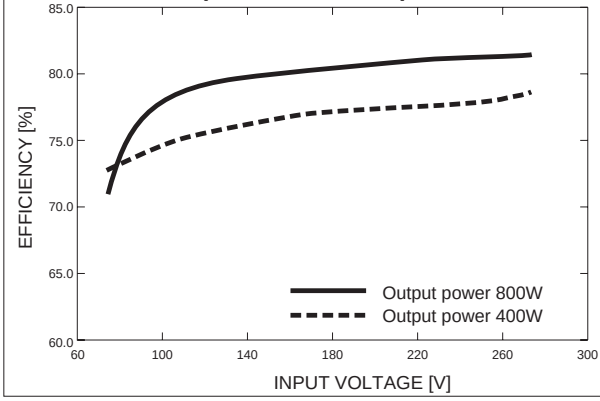
●INPUT HARMONIC CURRENT AC230V (AC9-HHEECC-00)



●POWER FACTOR & INPUT CURRENT (AC9-HHEECC-00)



●EFFICIENCY (AC9-HHEECC-00)



1 Ordering information ACE-14

2 Series operation and Parallel operation in Modular power supply ACE-15

2.1 Series operation ACE-15
2.2 Parallel operation ACE-15

3 Function ACE-15

3.1 Input voltage range ACE-15
3.2 Inrush current limiting ACE-15
3.3 Overcurrent protection ACE-16
3.4 Thermal protection ACE-16
3.5 Overvoltage protection ACE-16
3.6 Output voltage adjustment ACE-16
3.7 Remote sensing ACE-16
3.8 Remote ON/OFF ACE-17
3.9 Isolation ACE-17
3.10 Alarm ACE-17

4 Assembling and installation method ACE-18

4.1 Installation method ACE-18
4.2 Derating ACE-18

5 Option ACE-21

5.1 Option outline ACE-21

6 Input module ACE-23

7 Medical electrical equipment ACE-23

7.1 Type ACE-23
7.2 Specification ACE-23
7.3 Others ACE-23

1 Ordering information

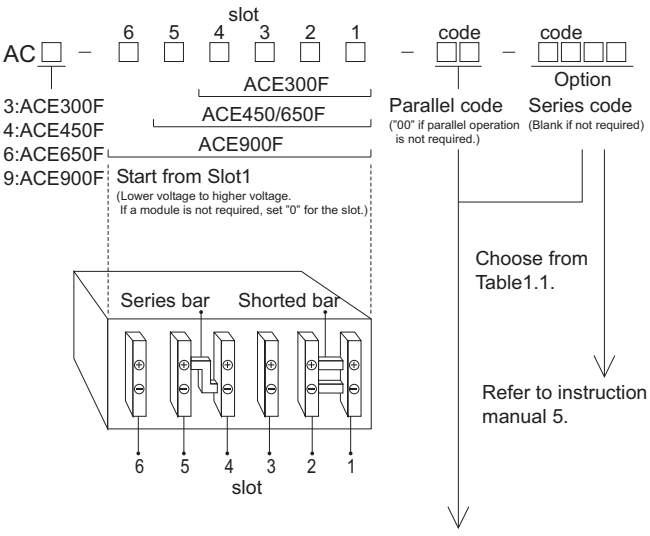
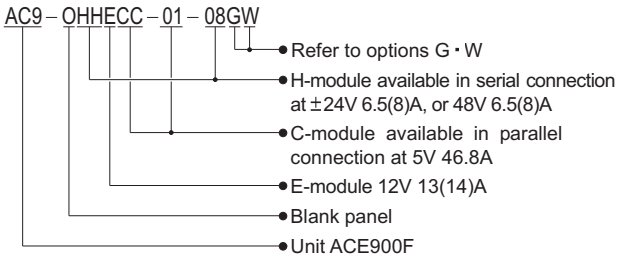


Table 1.1 Parallel / Series code

	code	slot6	slot5	slot4	slot3	slot2	slot1
ACE300F	00						
	01					●	●
	02				●	●	
	03				●	●	●
	04			●	●		
	05			●	●	●	●
	06			●	●	●	
	07			●	●	●	●
ACE450/650F	08		●	●			
	09		●	●		●	●
	0A		●	●	●	●	
	0B		●	●	●	●	●
	0C		●	●	●		
	0D		●	●	●	●	●
	0E		●	●	●	●	
	0F		●	●	●	●	●
ACE900F	10	●	●				
	11	●	●			●	●
	12	●	●		●	●	
	13	●	●		●	●	●
	14	●	●	●	●		
	15	●	●	●	●	●	●
	16	●	●	●	●	●	
	17	●	●	●	●	●	●
	18	●	●	●			
	19	●	●	●		●	●
	1A	●	●	●	●	●	
	1B	●	●	●	●	●	●
	1C	●	●	●	●		
	1D	●	●	●	●	●	●
	1E	●	●	●	●	●	
	1F	●	●	●	●	●	●

● : Output terminal
— : Connection

●PART NUMBERING EXAMPLE (1)


AC9 – OHHECC – 01 – 08GW
Refer to options G・W
H-module available in serial connection at ±24V 6.5(8)A, or 48V 6.5(8)A
C-module available in parallel connection at 5V 46.8A
E-module 12V 13(14)A
Blank panel
Unit ACE900F

●PART NUMBERING EXAMPLE (2)

If the parallel operating module C (5V, 46.8A) in example (1) is changed to module 2C(5V, 60A), the part number would change to AC9-0HHE2C-00-08GW.

●PART NUMBERING EXAMPLE (3)

Parallel and series operation of 2A-2K both use codes as in Table 1.1.

For example, if connecting two modules 2E [12V, 25(34)A] in series, and using these as 24V, 25(34)A, the part number would change to AC9-002E2E-00-02.

●Naming rules

(1) Confirm the output voltage and current, and select the code for output modules to be installed in slots 1-6 from the output module specifications. Use an "O" to designate slots where no output module will be installed.

(2) If the supply will be operated in parallel or in series, refer to Table 1.1 for the proper placement of the bus bar(s) between the output modules, and the appropriate code designation(s).

✱ Refer to section 2 for notes on settings for series and parallel operation.

(3) A minimum of two slots must be filled.

(4) List of modules which may be used for series or parallel operation.

Parallel setting	possible	A-K, 2A-2K
	impossible	L, M, N, P, R, S, T, U, Y, W, Z, 9, Q, V
Series setting	possible	A-K, 2A-2K, L, M, N, P, R
	impossible	S, T, U, Y, W, Z, 9, Q, V

■Series operation can provide a higher maximum output voltage, depending on the modules used. In addition, series operation provides a dynamic load response superior to that of parallel operation during abrupt changes in load. Therefore, we recommend operation in series for dynamic loads in order to increase power.

2 Series operation and Parallel operation in Modular power supply

2.1 Series operation

■Series operation is possible only between identical output modules. If series operation is specified in the part number, the supply will be shipped with a series bar installed. However, series operation is possible with modules S, T, U, Y, W, Z, 9, Q, and V, but series bar cannot be specified.

■The output current in series operation is the same as that of the individual modules that are connected.

■Please consider the following items when configuring your supply for series operation:

①Connect only the same type of modules in series.

②A total rated voltage of up to 48V can be set up for series operation.

③Modules in the same power supply can be set up for series or parallel operation, but not both.

Please consult with us for usage other than in accordance with the above conditions.

2.2 Parallel operation (applying module : A-K, 2A-2K)

■Parallel operation is possible using modules with identical output voltage. If parallel operation is specified in the part number, the supply will be internally configured accordingly, and shipped with the appropriate bus bar in place. Parallel operation cannot be set up once the unit has been shipped.

■Output current in parallel operation.

Current ratings for output modules connected in parallel are derated by 10%.

Ex.: AC4-HHECB-08

- Parallel code 08 means slots 4 and 5 are connected in parallel.
- The output module for slots 4 and 5 is "H". Therefore, the current is as shown below:

Current = (6.5A+6.5A) × 0.9=11.7 A

■Please consider the following when configuring your supply for parallel operation.

①Please consult us as regarding usage methods for remote sensing.

②Peak loads cannot be obtained.

③In case that output voltage adjustment is required for modules connected in parallel, the modules aforementioned must be adjusted. If precision adjustment is required, remove the bus bar between modules, adjust the output voltage, and reinstall the bus bar. The output voltage difference will appear as load regulation. To reduce the regulation, adjust the output voltage as same as possible. Adjust the output voltage so that each voltage get same value to reduce the regulation.

④In case that output current changes rapidly such as pulse load, the output voltage fluctuation (dynamic load regulation) value may increase. Therefore, please consult us in advance if the unit will be used for such a application.

■At startup, modules connected in series or in parallel, may show stepped input and output voltage waveforms. This is due to a delay in the rise time.

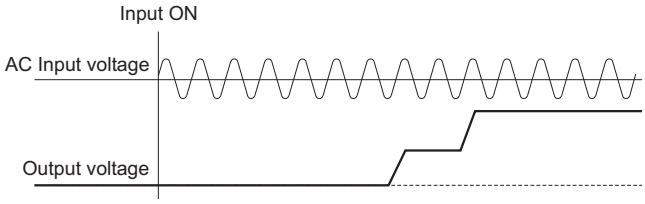


Fig. 2.1 Start-up waveform for series and parallel operation

3 Function

3.1 Input voltage range

■The input voltage range is from 85 VAC to 264 VAC, or 120 VDC to 350 VDC.

■In cases that conform with safety standard, input voltage range is AC100-AC240V(50/60Hz).

■Be aware that use of voltages other than those listed above may result in the unit not operating according to specifications, or may cause damage. Avoid square waveform input voltage, commonly used in UPS units and inverters.

3.2 Inrush current limiting

■Inrush current limiting is built-in.

■If a switch is being used for input, ensure that it is rated to handle the input inrush current. When turning the power OFF and then ON again within a short period of time, the inrush current limiting may be disabled, therefore, ensure sufficient time elapses before restarting.

■Inrush current limiting uses a thyristor, therefore primary inrush current and secondary inrush current are generated. If power is turned ON and OFF repeatedly, failure may result. Please allow enough time between power ON and OFF.

3.3 Overcurrent protection

■Overcurrent protection is built in (activated at 105% of the rated current, or for operation with peak current, at 101% of the peak current); however avoid short circuits or overcurrent.The unit automatically recovers when the cause of the short or overcurrent is cleared.

■When the output voltage drops as a result of the overcurrent circuit being activated, the average output current is reduced by intermittent operation of the power supply (intermittent overcurrent mode).

■Auxiliary power (AUX)

Output that supplies power to the RC terminal of output modules. AUX power is designed to be used for control of the remote ON/OFF function.

■Peak current protection (applicable modules: 2E-2K)

Peak current protection is built in (refer to Output module specifications ※1 for peak current usage methods).

Peak current protection operates independently for each output module. Its activation will not halt the entire power supply. Shut off input AC voltage, wait for at least 2-3 minutes, and recycle to recover output voltage(✱).

✱ The recovery time varies depending on input voltages and load status during operation.

3.4 Thermal protection

■Thermal protection is built in. If either of the following takes place, the thermal protection may be activated, shutting off the output:

①The current or temperature is continuously in excess of the derating curve.

②The fan has stopped or the airflow from the fan is reduced by an obstruction.

If the thermal protection is activated, shut off input voltage, remove the cause of the overheating, wait for the unit to cool down, and recycle to recover output voltage.

3.5 Overvoltage protection

■Overvoltage protection operates independently for each output module. Its activation will not halt the entire power supply.

Overvoltage protection is built in. When the overvoltage protection is activated, shut off input, wait for at least 1-2 minutes, and recycle to recover output voltage.

The recovery time varies depending on input voltage, etc.

・When testing the power supply for overvoltage performance or applying voltage from the load circuit, please note that components inside the power supply might fail if the voltage applied exceeds the rated output voltage.

3.6 Output voltage adjustment

■Output voltage can be adjusted by turning the internal potentiometer.

■Refer to specifications for adjustment ranges. Please consult with us regarding operation outside the specified ranges.

✱For modules Y, W, Z, 9, and Q, turning the internal potentiometer clockwise increases the positive voltage and decreases the negative voltage simultaneously.

3.7 Remote sensing (applying module : A-K, 2A-2K)

■Each output module incorporates remote sensing functions.

■If remote sensing is not used, then please short +S and +M, and -S and -M at the CN2 output module.

Fig. 3.1 shows wiring for when remote sensing is not used.

The unit is shipped with harnesses for when remote sensing is not used.

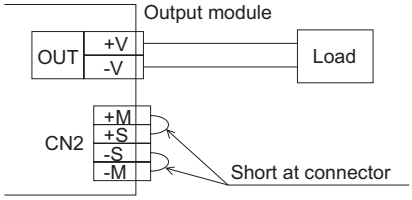


Fig. 3.1 When the remote sensing function is not used

■Wiring method with remote sensing is shown in Fig.3.2.

■Please consider the following when using remote sensing:

①Be sure connections are made properly. If the load wire is not connected correctly, a load current may flow through the sensing wire, which could damage circuitry inside the power supply.

②Wire of an appropriate type and gauge should be used to connect the power supply to the load. Line drop should be less than 0.3V.

③When using the remote sensing function, oscillation in the power supply output voltage, or significant variations in output voltages can be generated by wiring or load impedance.

The following are ways to remedy instability in output voltage.

・Remove remote sensing from the negative side, and short -S and -M at the CN2 on each output module.

・If oscillation occurs, connect C_0, C_1, and R1.

Please consult us for details.

■Ensure that current is not drawn from the CN2 +M or -M terminals.

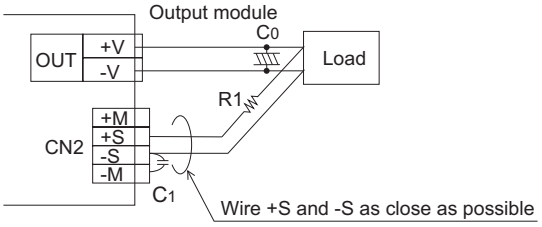


Fig. 3.2 When the remote sensing function is used

3.8 Remote ON/OFF

■Each output module incorporates remote ON/OFF functions. Output voltage ON/OFF can be controlled by applying a voltage to CN2 at each output module.

■Dedicated auxiliary power (AUX) for remote ON/OFF.
Auxiliary power (AUX) is built-in for control of remote ON/OFF.
Auxiliary power (AUX) is isolated from input, output, and FG.
Remote ON/OFF connection methods with AUX are shown in Fig. 3.3.

■Remote ON/OFF control logic.
①The output stops when voltage (4.5 - 12.5V) is applied to RC+.
✱Reverse logic option (-R) also available.Refer to section 5. Option.
②The built-in fan does not stop even if the output is turned OFF using remote ON/OFF.
③If the output has been turned OFF using remote ON/OFF, the LV alarm signal will be generated (except modules, S, T, and U).
④This function operates on each output module independently.

■Remote ON/OFF circuits operate independently on each output module; therefore it is possible to use remote ON/OFF on individual output modules. Please be aware that this cannot turn off all outputs together. If turning off all output modules together is a requirement, we recommend use of the remote ON/OFF circuits in series or parallel.

■The remote ON/OFF circuit (RC+, RC-) is isolated from input, output, and FG.

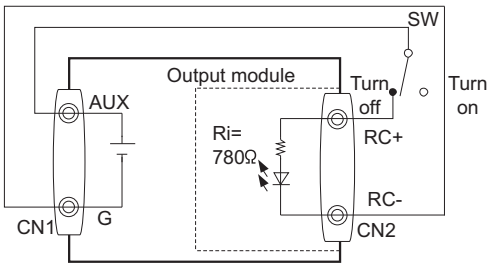


Fig. 3.3 Example of use with remote ON/OFF

Table 3.1 Remote ON/OFF specifications

Connection method		Fig 3.3 Remote SW
SW Logic	Turn on	SW open (0-0.5V between RC+ and RC-)
	Turn off	SW close (12V between RC+ and RC-)
Bases terminal		CN2 RC-

3.9 Isolation

■When performing incoming inspections, ensure that the applied voltage is increased gradually. Additionally, when turning off power to the unit, use a dial to gradually reduce the voltage. Do not use a voltage tester in conjunction with a timer. Doing so may generate voltage several times higher than the applied voltage.

3.10 Alarm

■The following two types of alarm function are built in.
Refer to Table 3.2 for details.
①PR: abnormal input voltage, fan alarm
②LV : abnormal output module voltage (except modules S, T, and U).

Table 3.2 Explanation of alarms

	Alarm	Output of alarm
PR	When input voltage is abnormal (low input voltage) or the fan stops, the alarm signal is generated from CN1.	Open collector method Good : Low (0-0.8V, 1-20mA) Fail :35V max
LV	When rated output voltage decreases or stops, the alarm signal is generated from CN2. Note : ① In the event of overcurrent output (intermittent current), operation of the alarm will become inconsistent. ② The LV alarm is not isolated from output. Therefore, make sure all connections are correct when the power supply is used to supply negative voltage or is operated in series. (Refer to Fig. 3.5).	Open collector method Good : Low (0-0.8V, 1-20mA) Fail :35V max

Please consult us details.

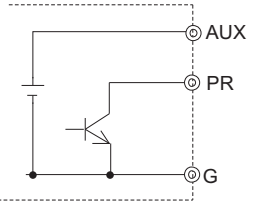
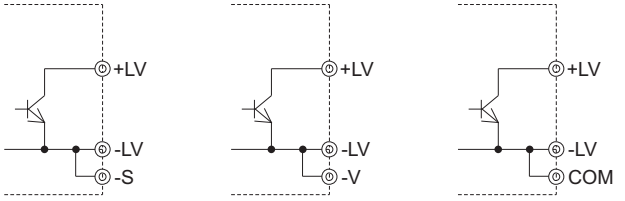


Fig. 3.4 PR internal circuit



Applying module : A-K, 2A-2K

Applying module : L, M, N, P, R

Applying module : Y, W, Z, 9, Q, V

Fig. 3.5 LV internal circuit

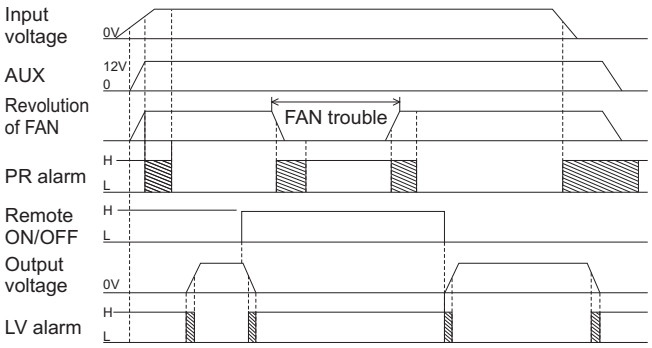


Fig. 3.6 Sequences for alarm types

4 Assembling and installation method

4.1 Installation method

■Fans for forced air cooling are built in.

Ensure that the inlet (rear) and outlet (output terminal) vents are not blocked, to prevent disruption of the airflow.

✱Option with reversed airflow (-F) is also available.

Fig. 4.1 Air flow

■If the unit is used in a dusty environment, an air filter should be used so the cooling efficiency of the fan is not reduced.

■If the fan stops, the thermal protection may be activated, shutting down the output. Life expectancy of the fan varies depending on usage conditions; therefore regular inspections of the fan are required for increased reliability. Should the fan become non-operational over the course of time, it can be replaced. Refer to the optional parts section of this catalog.

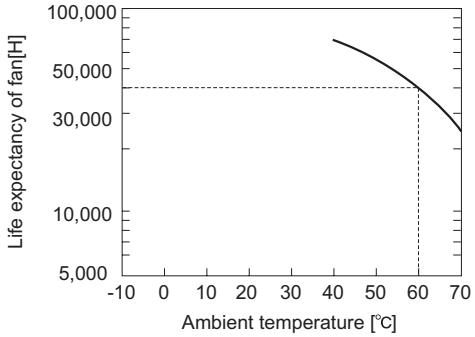


Fig. 4.2 Life expectancy of fan(R(t)=90%)

■When mounting the power supply with screws, it is recommended that this be done as shown in Fig. 4.3. If other methods are used, be sure the weight of the power supply is taken into account.

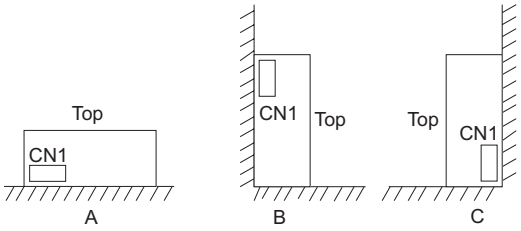


Fig. 4.3 Installation method 1

■Avoid installation method 2 as shown in Fig. 4.4, which can cause stress on the mounting holes.

■Maximum length of mounting screws is 6mm (Refer to Fig. 4.5).

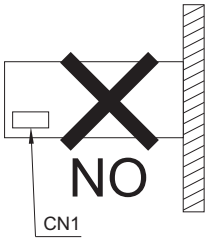


Fig. 4.4 Installation method 2

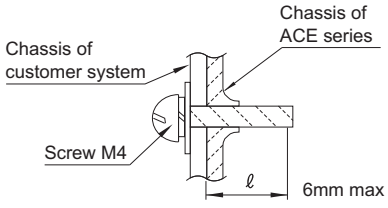


Fig. 4.5 Mounting screw

4.2 Derating

■The ACE series comprises power supplies consisting of a combination of output modules. Make sure each output module is used within specifications, and that the total output power of all modules is equal to, or less than the rated total output power.

■The derating curve for the ambient temperature (inlet temperature for cooling) of output modules is shown in Fig. 4.6.

■Operation within the hatched area will result in different ripple and ripple noise specifications.

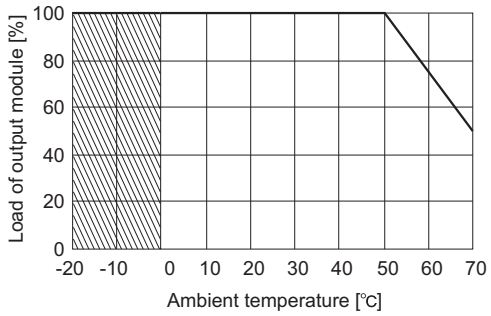


Fig. 4.6 Derating curve for ambient temperature

■The derating curve with respect to input voltage is shown in Figs. 4.7 to 4.10.

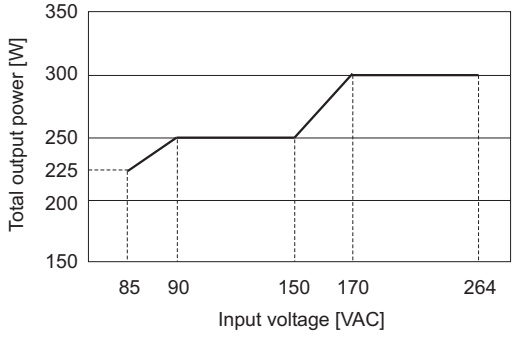


Fig. 4.7 Derating curve for input voltage (ACE300F)

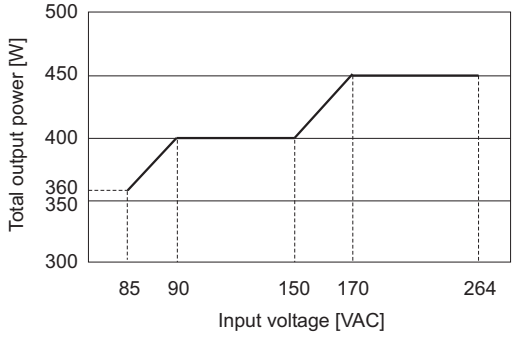


Fig. 4.8 Derating curve for input voltage (ACE450F)

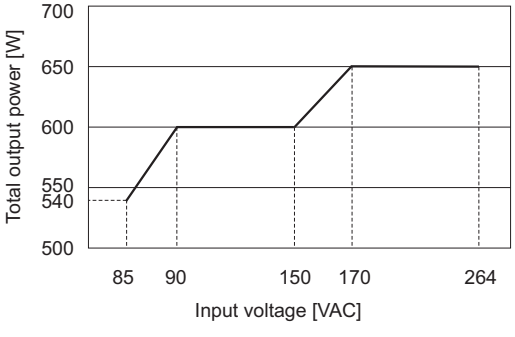


Fig. 4.9 Derating curve for input voltage (ACE650F)

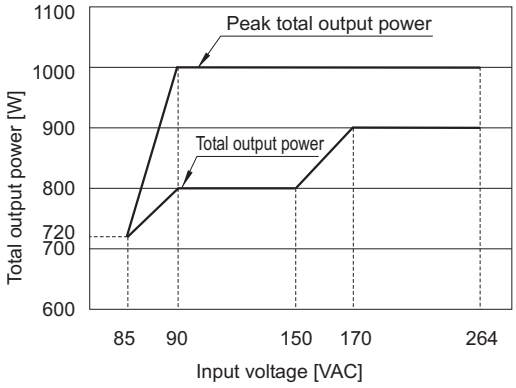
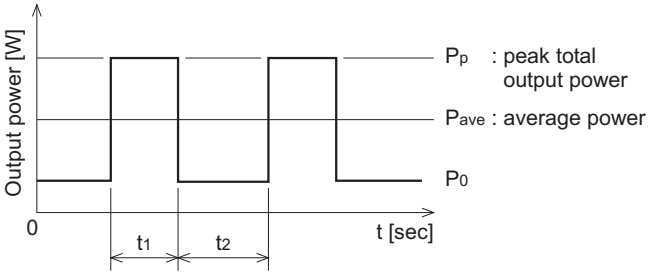


Fig. 4.10 Derating curve for input voltage (ACE900F)

■The ACE900F can output peak power under the following conditions.



$t_1 \leqq 1$ [sec], $P_{ave} = \frac{P_p t_1 + P_0 t_2}{t_1 + t_2} \leqq$ total output power, $\frac{t_1}{t_1 + t_2} \leqq 0.3$

Fig. 4.11 Peak output power (ACE900F only)

■Definition of load factor

$$A_0 = \frac{\text{(Sum of each module power)}}{\text{(Total output power)}} \times 100$$

$$= \frac{\sum_{k=1}^{6} (I_{k1} \times V_{k1} + I_{k2} \times V_{k2})}{\text{(Total output power)}} \times 100$$

Note : Only the number with a small occupation slot number is calculated in 2A-2K.

$A_{11}, A_{21}, A_{31}, A_{41}, A_{51}, A_{61}$: $A_{k1} = I_{k1} / I_{0k1} \times 100$

$A_{12}, A_{22}, A_{32}, A_{42}, A_{52}, A_{62}$: $A_{k2} = I_{k2} / I_{0k2} \times 100$

I_{k1} , V_{k1} , I_{0k1}: output current (✱1), voltage, and rated current (✱2) for modules S, T, and U (excepting V2).

I_{k2} , V_{k2}, I_{0k2} : output current, voltage, and rated current for V2 in modules S, T, and U.

Total output power: Dependent upon input voltage (Refer to Figs.4.7-4.10)

✱1 The output current for module codes Y, W, Z, 9, Q, and V is the sum of + and - output currents.

✱2 Rated output for modules is as below.

・Excepting module codes Y, W, Z, 9, Q, and V
: Refer to output module specifications

・Module codes Y, W, Z, 9, Q, and V
: 10A(Y), 6.4A(W) , 5A(Z), 3.2A(9) 12.8A(Q), 11A(V)

(Sum of +current and -current)

Load [%]=maximum value of A_0 to A_{62}

■Load regulation in modules Y, W, Z, 9, Q, and V

Ensure that the sum of + and - output is less than total output as follows: Y: 50W, W: 76.8W, Z: 75W, 9: 76.8W, Q: 153.6W, and V: 165W.

The relationship between current and load regulation is shown in the following example(Refer to Fig. 4.12).

<Example for module W>

(1) Rated current 1 : 3.2A ---When drawing current within the range of +3.2A and -3.2A (total 6.4A), the specifications of load regulation are as in "Load regulation 1".

(2) Rated current 2 : 4.2A ---When drawing current within the range +4.2A and -2.2A (or +2.2A and -4.2A, total 6.4A) the specifications of load regulation are as in "Load regulation 2".

(3) Peak current : 5A ------Loads of +5 A and -1.4 A (or +1.4 A and -5A, total 6.4A) are possible. However, refer to Output Module Specifications ✱1 when drawing 4.2-5A.

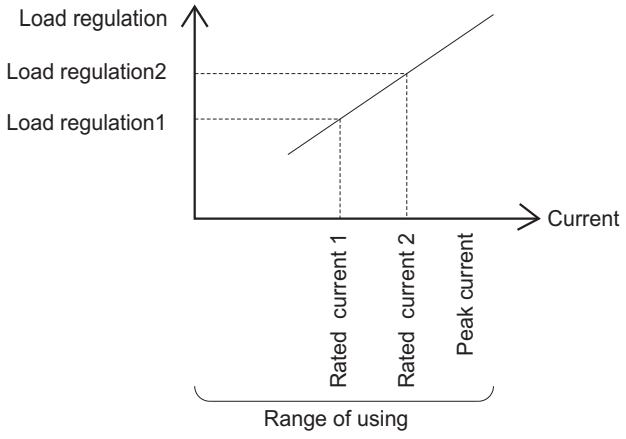


Fig. 4.12 The relationship between rated current and load regulation

■Minimum output current of modules S, T, and U.

The allowable load of V2 dependent upon the output current of V1 changes as follows.

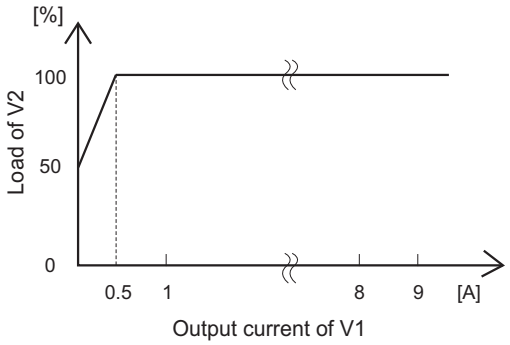


Fig. 4.13 Minimum output current of V1

■Usage example

[Example1] Method to confirm that AC4-LWHEC-00 can be used under the following conditions.

Input voltage : 100 VAC

Ambient temperature : 50℃

Ouput module : slot1 : 5V 15A

slot2 : 12V 7A

slot3 : 24V 6A

slot4 : +12V 4A, -12V 1A

slot5 : 3.3V 10A

Calculating A_{11}-A_{51}

$$A_0=\frac{\text{(Sum of each module power)}}{\text{(Total output power)}}\times 100$$

$$=\frac{\sum_{k=1}^{6}(I_{k1}\times V_{k1}+I_{k2}\times V_{k2})}{\text{(Total output power)}}\times 100$$

=396/400×100=99%

$A_{11}=I_{11}/I_{011}\times 100=15/26\times 100=58\%$

$A_{21}=I_{21}/I_{021}\times 100=7/13\times 100=54\%$

$A_{31}=I_{31}/I_{031}\times 100=6/6.5\times 100=92\%$

$A_{41}=I_{41}/I_{041}\times 100=5/6.4\times 100=78\%$

$A_{51}=I_{51}/I_{051}\times 100=10/10\times 100=100\%$

Accordingly, because the derating curve (Fig. 4.6) indicates that up to 100% of the maximum load can be used up to 50℃ and the largest value amongst A_0, A_{11}, A_{21}, A_{31}, A_{41}, and A_{51} is 100%, this assures that these input and output conditions are acceptable.

[Example2] Method to confirm that AC9-2HCSWP-00 can be used under the following conditions.

Input voltage : 100 VAC
Ambient temperature : 50℃
Ouput module : slot1 : 15V 3A
slot2 : +12V 3.2A, -12V 2.3A
slot3 : 5V 8A, 5V 4A
slot4 : 5V 25A
slot5 : 24V 13A

Calculating A_{11}-A_{51}

$$A_0 = \frac{\text{(Sum of each module power)}}{\text{(Total output power)}} \times 100$$

$$= \frac{\sum_{k=1}^{6}(I_{k1} \times V_{k1} + I_{k2} \times V_{k2})}{\text{(Total output power)}} \times 100$$

=608/800×100=76%
$A_{11}=I_{11}/I_{011}\times100=3/4\times100=75\%$
$A_{21}=I_{21}/I_{021}\times100=5.5/6.4\times100=86\%$
$A_{31}=I_{31}/I_{031}\times100=8/10\times100=80\%$
$A_{32}=I_{32}/I_{032}\times100=4/5\times100=80\%$
$A_{41}=I_{41}/I_{041}\times100=25/26\times100=96\%$
$A_{51}=I_{51}/I_{051}\times100=13/14\times100=93\%$

Accordingly, because the derating curve (Fig. 4.6) indicates that up to 100% of the maximum load can be used up to 50℃ and the largest value amongst A_0, A_{11}, A_{21}, A_{31}, A_{32}, A_{41}, and A_{51} is 96%, this assures that these input and output conditions are acceptable.

5 Option

5.1 Option outline

■Please contact us in advance as regards detailed specifications and delivery.
■Please refer to "1. Ordering information" for ordering methods.
■While some combinations of options are possible, others are not. Please contact us for details.

●-E, -G
・Reduced leakage current type.
・Differences from standard products are shown Table 5.1.

Table 5.1 Reduced leakage current

	-E	-G
Leakage current (230 VAC)	0.5mA max	0.15mA max
Conducted Noise	Class A	Not available
Ripple Noise	1.5 times standard	2.0 times standard

●-F
・Specification with reversed air exhaust
・Differences from standard products are shown in Fig.5.1 and Fig.5.2.
・Please contact us for details about life expectancy of fan.

Fig. 5.1 Air flow(-F)

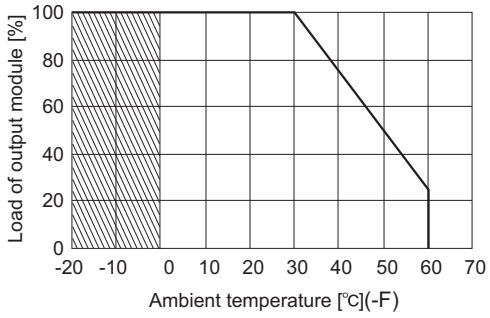


Fig. 5.2 Derating curve characteristics resulting from ambient temperature (-F)

✱The derating curve of output modules based on input voltage is also different for the ACE900F.

●-N(External specifications may vary; please contact us for details)
・In the event that cooling can be provided by the user's fan, the built-in fan may be eliminated (Refer to Fig.5.3).
・If applying for agency approval, it is necessary to measure the temperature of the transformer.
・Please contact us for details on cooling methods.

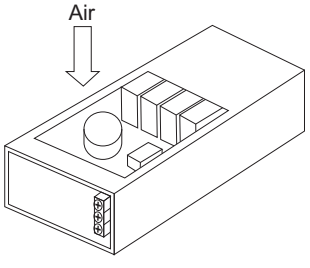


Fig. 5.3 Dwg. of -N specification

●-K

・Specification with lower speed fan for reduced noise.

・The difference from standard is shown Fig.5.4.

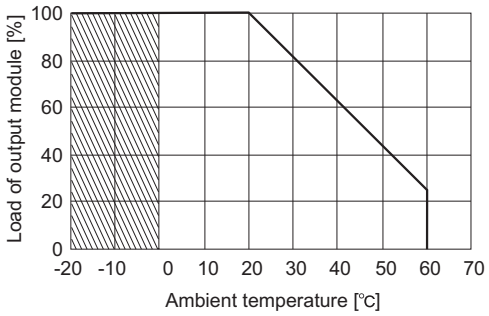


Fig. 5.4 Derating curve based on ambient temperature (-K)

●-R

・Specification with reversed logic for remote ON/OFF operation.

・If -R is specified, then even if input voltage is applied to the module, it will not function as long as voltage is not applied to the RC terminal.

Turn on : 12[V] between RC+ and RC-
Turn off : 0-0.5[V] between RC+ and RC-

・-R specification applies to all installed output modules.

・A harness is required for connecting to CN2 when using these specifications.

・Please use H-SN-16 to H-SN-18, etc.

・When the customer is to provide a harness, please note the remote sensing wiring (refer to section 3.7, "Remote Sensing").

・Please consult us if specifications that mix normal logic and reverse logic are required.

●-T(External specifications may vary; please contact us for details)

・Specification that adds a filter to prevent the entry of foreign bodies.

・The difference from standard products is shown in Fig.5.5.

・Combinations with -F and -K are not possible.

・Dust can result in clogging and reduced cooling; therefore it is required that the unit is used in a dust-free environment, or that it is periodically cleaned.

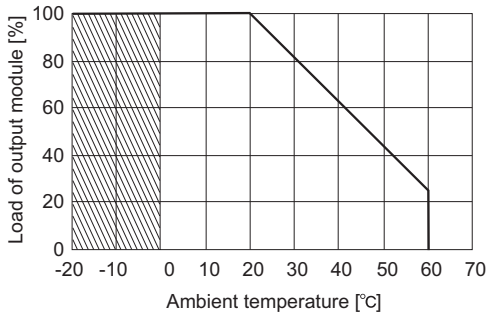


Fig. 5.5 Derating curve for operational ambient temperature (-T)

●-U

・Specifications for support of instantaneous voltage dips (low input voltage support).

・Use condition

Input	70 VAC(100 VDC)	
	Duty 1s/30s	
Output	ACE300F	200W
	ACE450F	360W
	ACE650F	540W
	ACE900F	720W

✱Avoid continuous use for more than 1 second under the conditions mentioned above, as such use can lead to damage to the power supply.

●-W(External specifications may vary; please contact us for details)

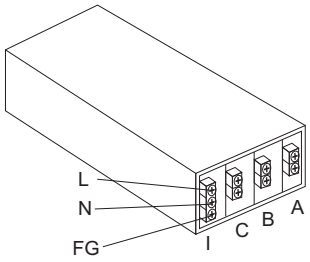
・Specification with terminal covers attached to output modules.

・If -W is specified, a terminal cover is attached to all installed output modules.

6 Input module

Input terminals for the ACE300F, 450F, and 650F are upon the fan mount surface, however these can be situated on the output side. This places the input module (I) in the far left slot of each module, instead of the output module.External dimensions will change. Consult us for details.

ex : AC3 – I CBA – 00
Output module
Input module



✱With module I specified, conducted noise is class A.

7 Medical electrical equipment

・Specifications supporting medical electrical equipment.Types and specifications, etc. are below. Please contact us for details.

7.1 Type

AC□ – □ □ □ □ □ – □□ – H

When units that support use as medical electrical equipment and other options are combined, the end of the type name is as follows.

AC□ – □ □ □ □ □ – □□ – H○△

✱ ○ , △ :other options

Refer to instruction manual 5. for Option.

Example of use in conjunction with option -K model (reduced fan speed).

AC□ – □ □ □ □ □ – □□ – HK

✱Options that cannot be used in conjunction with this are as follows:

C : coating

E : low leakage current

✱ Option -H is a low leakage current specification product. Refer to section 7.2 for details.

7.2 Specification

・Safety : UL60601-1 (CSA601.1), EN60601-1

・Isolation : 4,000 VAC input-output, RC, AUX 1min.
cutoff current 10mA

・leakage current : 0.3mA max (100 VAC), 0.5mA max (230 VAC)
✱0.1mA max. is also possible.

・conducted noise : complies with FCC-A, VCCI-A, CISPR22-A, EN55022-A

・Supported modules

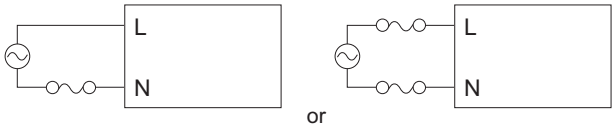
All modules except S, T, and U modules with "output module specification." Please note that there is no support for modules S, T, and U.

・Ripple noise

Ripple noise is 1.5 times that of standard models.

7.3 Others

・If applying for medical equipment agency approval, use fuses or breakers that comply with applicable safety regulations on input terminals.



FUSE ACE300F 250 VAC8A ACE450F 250 VAC10A
ACE650F 250 VAC15A ACE900F 250 VAC20A

Fig.7.1 Connecting FUSE

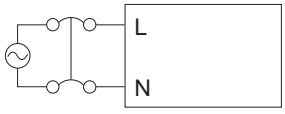


Fig. 7.2 Connecting circuit breaker